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UNITED STATES DEPARTMENT OF AGRICULTURE

## FOREST SERVICE

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# BRANCH OF RESEARCH

## MONTHLY REPORT

OF

FOREST EXPERIMENT STATIONS

FOREST PRODUCTS

FOREST ECONOMICS

RANGE RESEARCH



February, 1930





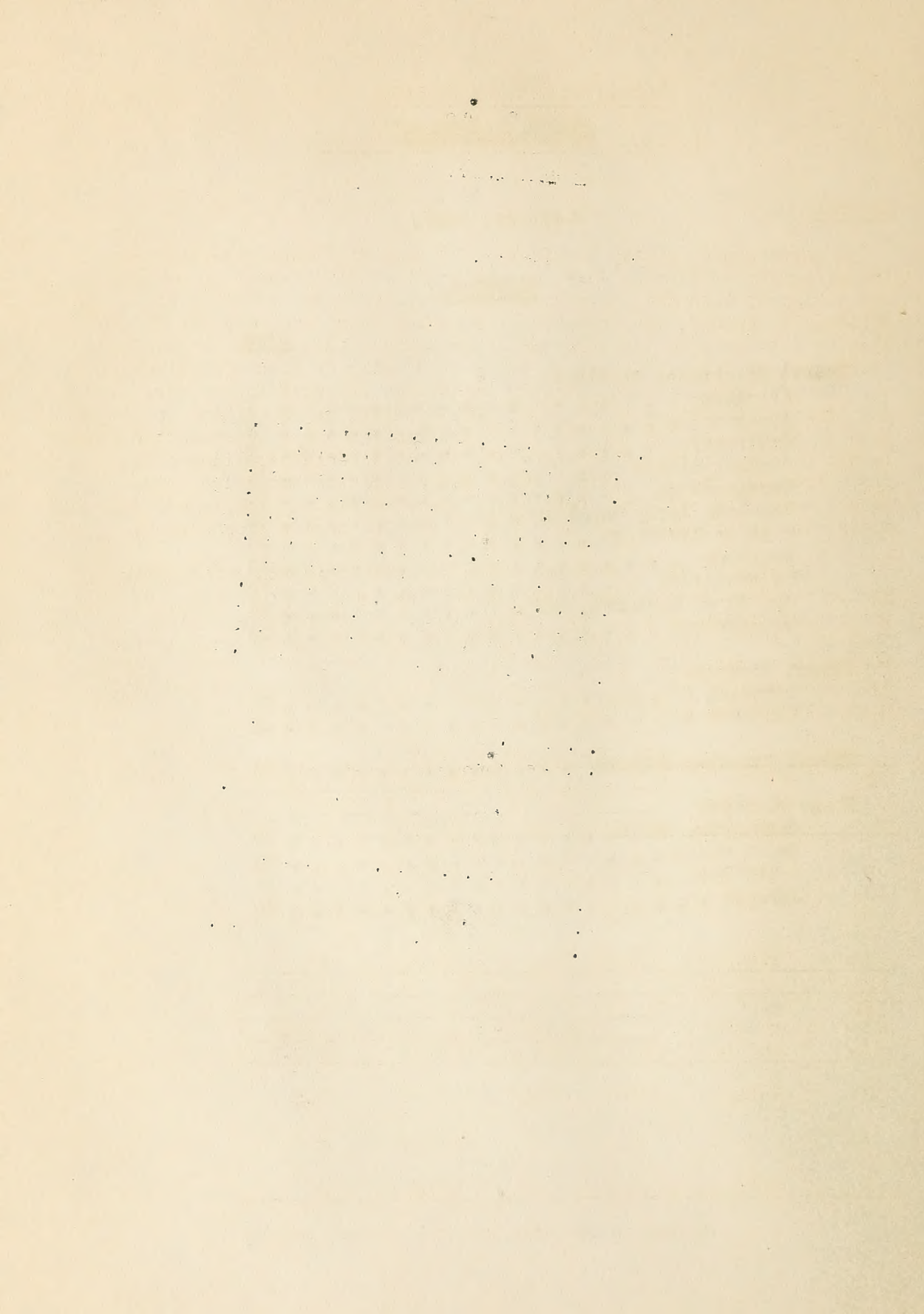


# BRANCH OF RESEARCH

February, 1930.

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## FOREST EXPERIMENT STATIONS

### ALLEGHENY FOREST EXPERIMENT STATION

#### General

Appointment of two men from the Office of Forest Pathology to the Allegheny Station on July 1 seems sufficiently assured to warrant our taking up with the University of Pennsylvania the question of office, laboratory, and greenhouse space for these men, and for Hatch, when he returns from his European studies under Melin. The arrival on February 1 of Dr. H. H. York to become Professor of Plant Pathology in the University has already greatly stimulated interest in the work of the Experiment Station, and the University will "go the limit" in giving us more space. At the very least we are assured three well-lighted rooms in the Botany Department's "annex No. 4", a converted dwelling about a block from our present office, which can readily be converted into laboratories and offices. Greenhouse space sufficient for immediate needs will be provided in a new wing of the University greenhouses.

In view of the dependence which we are placing on our "safety strips" at Ockanickon, constructed according to the latest ideas of the administrative men in New Jersey, it is a little disconcerting to find that the moisture content of both the litter and the duff on the strips is consistently lower than on adjacent untreated ground. Morey took some samples of both litter and duff during October and analyzed them with the following results:

#### PER CENT MOISTURE CONTENT\*

Days	Before	LITTER			
		Fire line		Check plots	
		Plot 1	Plot 5	Plot 6	Plot 9

2	Before	105.9	121.5	135.5	106.9
---	--------	-------	-------	-------	-------

3	"	79.8	-	127.2	-
---	---	------	---	-------	---

1	After	35.4	-	85.6	-
---	-------	------	---	------	---

Days	Before	DUFF			
		Fire line		Check plots	
		Plot 1	Plot 5	Plot 6	Plot 9

2	Before	109.8	81.7	136.9	79.5
---	--------	-------	------	-------	------

3	"	75.0	-	144.5	-
---	---	------	---	-------	---

1	After	80.8	-	139.7	-
---	-------	------	---	-------	---

\*Based on oven-dry weights of each sample.

(Over)



Unfortunately, the samples were not of fixed size, and at that time we had no means of gauging the rainfall to which the table refers.

Mr. John Curry, in charge of fire protection for Maryland, visited the office in connection with a meeting which Forbes had arranged for him with Dr. R. H. Fernald, Dean of the Towne Scientific School, Mr. C. G. Worthington, Research Assistant of the American Society of Mechanical Engineers, and Mr. C. P. Dampman, Supervisor of Fuel Conservation for the Reading Railroad. The object of the meeting was to decide on a line of action for a committee, on railroad spark arresters, of the Allegheny Section; of this committee Curry is chairman. Should investigation prove that the railroads themselves have not assembled enough information on spark arresters to justify the conclusion that no improvement in these devices is possible, the University of Pennsylvania may be asked to undertake a special study. Perhaps the most encouraging thing brought out at this conference is that the less smoke which emerges from a locomotive stack, the less the fuel consumption. The foresters' experience of many years points to the unlikelihood that the railroads will go very far toward perfecting spark arresting devices merely in order to avoid law suits for firing their rights-of-way; conservation of fuel may prove to be a vastly more potent incentive.

Among our visitors have been Dr. Hawley of the Madison Laboratory who called at the University of Pennsylvania in search of recruits for the Laboratory's staff, and Mr. E. S. Cary, Superintendent of the Pocono Lake Preserve. The Preserve is a tract of about 2000 forested acres in the Pocono Mountains of Pennsylvania. About half of the forest contains spruce, but Mr. Cary has a high regard for hemlock, as a general-purpose softwood. The Preserve is close enough to the anthracite coal fields to have excellent markets for small material as well as saw-logs.

### Management

Considerable progress has been made in the analysis of the extensive survey data of '28 and '29. Hough has summarized the data from about 10 plots examined in 1928, all in stands containing much white pine. In order to facilitate further study, he has prepared an elaborate summary sheet describing in compact form the virgin stands, and those which have followed it. In some instances the present stand is third growth, and the studies have given us three stages in the evolution of this type under man's influence.

Wood has summarized the data obtained in 1929 on a white pine area in northeastern Pennsylvania. The data on distance of seedling from a group of seed trees has already appeared in a previous report. Since November Wood has learned from a local scientist that the original forest surrounding the area studied was mostly hemlock, with some black



cherry, birch, and soft maple. The group of seed trees established themselves on an old field, and have only reproduced following a severe fire. Seven years after the fire the number of seedlings currently established reached a maximum, but a few seedlings came in over a period of 17 years. This study certainly confirms the conclusion tentatively reached at Heart's Content and other points on the Allegheny Forest, to the effect that white pine is a "child of catastrophe"; moreover, the relatively long period during which white pine has been able to establish some seedlings each year tends to explain the range of 35 years in the age of the 250-year old white pine in Heart's Content. In second-growth stands produced through management a difference of 17 years in the age of trees would preclude classifying the stand as even-aged, but this is a relatively short period in the life of a mature pine of the virgin forest.

### Measurements

Schnur and Morey completed the remeasurements of 24 loblolly pine plots on the Eastern Shore of Maryland, survivors of about 70 plots laid out in 1906. Four others had suffered from a severe fire which made some of the painted numbers practically invisible. However, this mishap should not be considered a triumph for the advocates of metal tags in place of painted numbers. Mischiefs makers had switched a lot of the tags on one plot, but remeasurements were still possible because the original painted numbers, were still visible, even after 10 years. Schnur and Morey did conclude, however, that the 2-inch numbers stamped on trees following Norwegian methods are not sufficiently large to remain legible when placed on fast-growing species like loblolly pine. They made the interesting discovery that in the extremely damp climate of the Eastern Shore many aluminum tags hung on copper nails are so damaged in 4 years by electrolytic action as to drop off. The aluminum tags hung on galvanized iron nails were not so affected, because the potential of aluminum and zinc is nearly the same.

### Protection - Insects

We have long suspected from casual evidence that the habits of the white pine weevil in our territory, at least on the fringe of the white pine range, differ from those of the weevil in New England. We have observed repeatedly that 1 or 2 white pine seedlings apparently completely isolated from other pines in a broad valley on the Allegheny National Forest were nevertheless very thoroughly weeviled; this certainly is not in line with MacAloney's recent pronouncement from Syracuse that white pine on the western edge of its range is rarely weeviled. Wood's study of white pine near Dushore, Pa., already referred to, gives some interesting concrete evidence on the effect of local isolation. Wood tallied the seedlings on 36 tenth-acres around a group of seed trees, and found weevil injury to be greater on those plots bearing small numbers of pines than on those bearing large. He



did find, however, that a higher percentage of trees with free crowns were weeviled than of trees which were overtopped. Curiously enough curves based on 88 uninjured seedlings, and 164 which were weevil-damaged, all chosen at random, showed that the weeviled trees were consistently taller, and that their superiority in height increased with greater age.

### Types

Morey completed range maps for over 100 of our chief species. In connection with our effort to establish why there should be so marked a difference in forest productivity between south Jersey and the Eastern Shore of Maryland, Morey has examined the soil maps and finds that the proportion of good and bad soils appear to be about equal in both regions. Rainfall appears to be somewhat higher in south Jersey than in Maryland, but temperatures are somewhat lower. Morey found that the southern limit of chestnut oak practically coincides with the northern limit of loblolly pine within our territory. The dividing line closely follows the  $54\frac{1}{2}^{\circ}$  F. mean annual isotherm,  $72^{\circ}$  normal summer isotherm,  $62^{\circ}$  mean minimum summer isotherm,  $82^{\circ}$  mean maximum summer isotherm, and a normal summer precipitation of from 16 to 17 inches.

We have obtained from the Pennsylvania Department of Forests and Waters a large scale map of the occurrence of the beech-birch-maple type (birch-maple-hemlock type of the Section committee), and have compared this distribution with his climatic maps. The following table is based on this comparison:

Climatic Factor	Beech-birch- maple	Entire Region
Normal annual temperature	: $44^{\circ} - 49^{\circ}$	: $44^{\circ} - 57^{\circ}$
Average date of last killing frost in spring	: Apr. 20 - June 10	: Apr. 10 - June 10
Average date of first killing frost in fall	: Sept. 10 - Oct. 30	: Sept. 10 - Nov. 10
Average length of growing season, days	: 120 - 165	: 120 - 224
Normal summer temperature (June-Sept. incl.)	: $63^{\circ} - 68^{\circ}$	: $63^{\circ} - 75^{\circ}$
Mean minimum summer temper- ature (June-Sept. incl.)	: $53^{\circ} - 55^{\circ}\frac{2}{3}$	: $53^{\circ} - 67^{\circ}$
Mean maximum summer temper- ature (June-Sept. incl.)	: $74^{\circ} - 79^{\circ}\frac{3}{4}$	: $74^{\circ} - 85^{\circ}$
Normal annual precipitation	: 38" - 50"	: 34" - 50"
Mean summer precipitation (June-Sept. incl.)	: 14" - 19"	: 14" - 20"



1/General. Few exceptions as noted under factor under consideration. Cities such as Erie and Scranton may have some effect.

2/Except Scranton (57°) and Erie (60°).

3/Local variations in Alleghenies to 82 - local climate may vary from that shown on our small scale chart.

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## APPALACHIAN FOREST EXPERIMENT STATION

### General

The weekly seminars of the station members and other foresters in Asheville were continued during February. Korstian spoke on "The relation of plant sciences to silvicultural research"; Evans on "The Clarke-McNary law in relation to forestry in the Appalachians"; W. K. Beichler, district forester for North Carolina, on "The present and future fire situation in the Southern Appalachians"; and Nelson on "Forest pathology problems in the Southern Appalachians."

### Selective Logging of Loblolly Pine

MacKinney and Craig spent three weeks with the Forest Products Laboratory field party at Windsor, N. C., finishing the logging and milling work on the permanent sample plots there. The reexamination of these plots was postponed until spring because many logs remained to be hauled across them and the felling on the isolation strip had not been completed.

### Forest Soils Studies

Observations on the influence of topography and exposure on early spring soil temperatures are being recorded in connection with the forest soils project of the Station. On February 21, comparison of different locations on the Bent Creek Experimental Forest showed a range of 41° F. to 89° F. for the surface inch of soil at 2 p.m. Air temperatures showed a range of 66° F. to 71° F. Soil temperatures at the depth of 6" ranged from 41° F. to 53° F. The lowest temperatures were recorded on north slopes with rhododendron cover; the highest on relatively steep south slopes on areas where the mineral soil is exposed due to absence of litter.

The considerable difference in the early spring temperature, depending upon topography and exposure, is believed to be a pertinent factor which must be taken into account in order to understand certain



problems of reproduction and regeneration in the Southern Appalachians. Periods of warm temperatures simulating summer growing weather frequently occur in the late winter months and early spring in the vicinity of Asheville. On the other hand cold periods sufficient to freeze the surface soil may occur as late as April. Moderate slopes to the south and west are much warmer throughout the year but this difference is particularly marked in the early spring. Biological activity is greatly encouraged on the south and west slopes because of these higher temperatures.

It is expected that a more complete knowledge of soil and air temperatures in different topographic positions will assist in a better understanding of species distribution in the southern mountains.

### Forest Pathology

G. F. Cravatt, Senior Pathologist in the Office of Forest Pathology, visited the station and spent a day with Nelson in looking over tentative planting sites for chestnut at Bent Creek and Canton. Nuts from a number of Asiatic varieties of chestnut have been collected by R. K. Beattie, of the Office of Forest Pathology, and grown near Washington, D. C., and a large number of seedlings will be planted in various parts of the Southern Appalachians on different sites. It is hoped that the Asiatic chestnuts will prove as resistant in this country as in their native home and that they will be of value as a source of tannin, posts and poles, and edible nuts. A rather extensive planting is intended at Bent Creek provided a suitable area can be found.

### Forest Zoology

Burleigh spent 9 days in Washington during February. His time in Asheville was spent largely in the field at Bent Creek. His aim is to obtain, as a basis for further experimental work, first-hand knowledge of the bird and mammal life indigenous to the Southern Appalachians. He is therefore collecting specimens and making observations on the distribution, abundance, and life habits of the animals of this region. To date his collection consists of 56 birds and 12 mammals. The stomachs of these specimens are to be critically examined to learn the food habits of the animals. One of the first problems which will be attacked is the relation of animals to natural reproduction of timber. The opinion is held at the station that animals destroy each year so large a proportion of the seed crops as to seriously hinder the establishment of new tree crops. Changes in animal relationships following modifications of the environment by cutting are to be expected, and these may have an important bearing upon the composition of the reproduction, as well as upon soil and litter.



## CALIFORNIA FOREST EXPERIMENT STATION

Director Kotok left for Washington, D. C. on February 6. Considerable time has been given to preparations for a meeting at Los Angeles in March under the auspices of a sub-committee of the Irrigation Division of the American Society of Civil Engineers. The meeting will be devoted to the consumptive use of water by vegetation, in respect to which it is highly important to get across to engineers the concepts to which the work of this Station under Lowdermilk's projects is tending.

### Management

Assembling data from the Stanislaus woods and mill study plots was continued throughout the month by Hasel, Harlan and Dunning. Hasel has completed tracings of the three large plot maps showing damage by logging and the planimetering of these has been nearly completed by Harlan. The summary indicates the radical differences in marking between the three methods of cutting studied.

Original stand per acre in board feet and percentage left for each size class and species by light economic selection (Lt), Forest Service (FS), and heavy (Hv) marking - 45 acres.

Species:		:12-17	: 18-23	: 24-29	: 30-35	: 36-41	: 42+	:Total
	Tot. B.F.	60	100	425	775	970	8520	10850
WYP	%Lv.-Lt.	100.0	100.0	92.9	54.7	43.7	1.0	13.7
	" FS	78.9	74.3	51.6	45.9	38.6	1.1	10.7
	" Hv	91.7	0	0	0	0	0	0.5
	Tot. B.F.	290	420	770	1680	1730	17150	22040
SP	%Lv.-Lt.	100.0	100.0	100.0	86.3	39.0	2.1	18.0
	" FS	92.8	70.5	70.0	41.6	38.9	5.1	15.2
	" Hv	98.7	19.4	0	0	0	0	1.7
	Tot. B.F.	1520	2000	2740	4530	4210	8380	23380
WF	%Lv.-Lt	100.0	100.0	100.0	100.0	100.0	84.6	94.4
	" FS	97.8	84.9	48.7	22.7	4.1	0	24.4
	" Hv	98.2	39.2	10.6	6.5	5.6	5.3	15.1
	Tot. B.F.	140	240	455	1115	1500	3350	6800
IC	%Lv.-Lt	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	" FS	100.0	79.2	35.6	26.5	3.7	0	12.5
	" Hv	99.3	76.0	20.1	13.1	5.5	8.4	13.6
	Tot. B.F.	2010	2760	4390	8100	8410	37400	63070
All	%Lv. Lt	100.0	100.0	99.4	92.8	81.0	29.1	54.8
	" FS	96.7	82.0	51.3	29.4	15.1	2.6	17.6
	" Hv	98.2	37.9	8.8	5.4	3.8	1.9	7.8



Dunning completed a summary of Stanislaus Mc Plot 8 to show conditions before and after cutting, methods of study, etc., to bring together in one place all information necessary for future field work and preparation of reports. The original stand on the 8.4 acres averaged 87,900 bd. ft., of which 4.2 per cent was western yellow pine, 30.2 per cent sugar pine, 54.7 per cent white fir, and 10.9 per cent incense cedar. The stand left averaged 14,440 bd. ft., or 16.4 per cent of the original. Damage from felling, tractor yarding, and slash disposal was rather heavy. Of the trees 4 inches and larger unmarked, 24.5 per cent were destroyed. Of the smaller trees, or reproduction, 61 per cent were destroyed.

A special purpose of this plot is to determine whether sugar pine can be increased in a stand where natural replacement by fir is well advanced.

The revision of all other plot summaries is also being undertaken in preparation for a busy season of remeasurements. The conventional working plan has little value in work of this kind. For this reason a detailed manual of instructions applying to all experiments has been used for many years, supplemented by still more detailed summaries and instructions for each experiment. The latter are revised at each examination. In these summaries the object has been to include everything known about the project, as well as things that need to be done, so that future reports and field examinations may be thorough, even if a new man must do the work.

Neetzel has completed checking and summarizing data from 14 of the thinning and yield plots in even-aged second-growth. Previous unsatisfactory work of a temporary assistant has made this work more burdensome than if nothing had previously been done. Eight more plots remain to be worked over.

Reincke has undertaken again the analysis of temporary yield plot data for mixed even-aged stands. This work will be completed in a few days.

#### Cover Types

Southern California: - During the month there have been 10 men in the field as follows: 4 in Los Angeles County, 4 on the Santa Barbara National Forest, 1 on the Cleveland National Forest and 1 at large (Mr. Clar) picking up odds and ends and giving general supervision to the field work.

With the close of the month type data will be complete for Los Angeles County. St. John will then move to Riverside County where State Ranger Melander will provide transportation and assist him typing areas outside the National Forests in that county. Mr. Raymond will go to Monterey County where he will be similarly assisted by State Ranger Phelps.



Northern California:- Mr. Benedict of the Office of Blister Rust Control has made available to the Station cover type data secured by him on the Lassen, Plumas, Eldorado and Stanislaus Forests. These data will greatly strengthen the cover map for the sugar pine belt on these forests.

Both the Stanislaus and Sierra Forests are hard at it completing their cover maps. The Forester of the Pickering Lumber Company, the largest private timber owner on the Stanislaus, will prepare a cover map of their holdings to be incorporated in the National Forest Map. The Sierra has completed abstracting cruise data and requests that someone be sent from the Station to assist them for a few days in getting started on the field work. Wieslander is sending Mr. Clar.

The Mono sent in their completed cover map, the first to be received from the National Forests.

### Forest Influences

The month of February has been taken up with the preparation of manuscripts by Lowdermilk and Sundling. Three major working plans were completed to form a part of the Investigative report. A bibliography on transpiration studies has been prepared, and a portion of the works consulted.

Of particular interest was the visit of Dr. Matajira Tozawa, Director of the Seiryori Forest Experiment Station at Keijo, Korea. Lowdermilk was a guest at Dr. Tozawa's experiment station in 1926. The methods in erosion control employed by Dr. Tozawa are of particular interest in America. Whereas erosion control in Japan consists primarily in the mending of breaks in a landscape otherwise well covered with vegetation, that in Korea comprises the control of erosive processes of long standing and wide extent which have resulted from abuse of soil resources for centuries. Costs per unit area must therefore be kept down to make the work feasible. Dr. Tozawa's methods are aimed to do just this, and he has had remarkable success. Dr. Tozawa appeared to find the studies on erosion at Berkeley interesting, and it was a pleasure to review this contact.

### Products

Woods and Mill Study:- The depreciation section of the Pickering Lumber Co. woods and mill study is about ready to go forward for punchcarding at Madison. The saw-mill study forms, as they are being correlated prior to summarizing the lumber tally data by thickness and width classes, are showing some interesting indications of the deceptiveness of external appearance as a criterion of log grade when one attempts to base the grades on what he thinks the log will yield in terms of lumber grader percentages. Logs with many knots fairly



well scattered over most of the cylinder have heretofore been graded as No. 3 in California pines. In the Pickering study this grade was divided into No. 3 and No. 4, the former to include small-knotted logs cutting out a high proportion of No. 1 and No. 2 common and the latter to take care of the rough, big-knotted specimens, especially the upper portions of Class V trees. Presumably this type should yield mostly No. 3 Shop, No. 3 Common and lower. It is surprising to find that many of the roughest-of-the-rough produced enough No. 2 Shop and better to qualify as No. 2 Shop logs under the old grading rules. This indication applies to the larger logs only. The small material cut by the pony-band saw has not yet been checked.

California Economic Research Council:-A meeting of the Natural Resources Committee considered the memorandum on land use study prepared by Hill and Professor Weeks of the University. Very great interest is being taken in the possibilities opened up by this project and considerable progress was made in arriving at a common viewpoint.

Smoking Pipes:-An old Products activity in this District has been dragged from a long resting place in the files by the arrival of a representative of one of the large smoking pipe manufacturers from New York City, which is again interested in the possible replacement of French briar by California woods. It appears that the war time interest of the pipe manufacturers, due to war difficulties in obtaining French briar, has suddenly been revived by an advance of approximately 100% in the cost of briar due to the perfection of a monopolistic combine among the European producers.

### Entomology

During February most of the time of Person and Struble was spent in preparing reports on the field work of last season and in laboratory studies on the nutrition of the western pine beetle. Struble completed a preliminary report on the feeding habits of the adult western pine beetle. He found that the new adults feed as they emerge from the bark of infested trees and also while entering and extending galleries in the inner bark of newly attacked trees. No evidence of feeding during the flight period has been found. An attempt is now being made to rear the larvae on artificial media and to determine the effect of different sugars and yeasts on their development.

Person has spent most of his time on the preparation of a report on his attraction studies, which has just been completed. As a result of these studies it is now believed that the western pine beetle is attracted by some volatile substance such as an aldehyde, or ester which is produced as a by-product of respiratory fermentation in the inner bark of subnormal standing trees or felled trees. Another report is now being prepared on the biological control studies of last season in which the effect of bark temperature on both the western pine beetle and its important predators was considered.



## CENTRAL STATES FOREST EXPERIMENT STATION

### General

This month has been occupied largely by office work on the several station projects but included several public addresses by members of the staff.

The combined program of Farmers' Week and the Ohio State Forestry Association provided a good attendance at meetings on February 5th and 6th. Three members of the Station staff addressed these meetings.

McCarthy spoke on the subject, "Lumber for the Farm" using slides for illustration. Later Day gave a paper on "Woodland Grazing in the Corn Belt" in which he traced the changes which occur in the farm woods from the entry of stock into an ungrazed lot to the disintegration of the woods into a parklike matted pasture. Many excellent pictures illustrated these changes. Kellogg read a paper on "Planted or Grove Black Walnut" which was illustrated by pictures taken last summer.

McCarthy made a trip to the Forest Schools at Purdue University and the Iowa Agricultural College at Ames, Iowa. On this trip he also spoke before the Illinois Farmers' Institute at Galesburg, Illinois. At the Institute meeting a very representative group of Illinois farmers heard the address and passed a resolution favoring more extensive forestry endeavor in the state. The Institute has set up as an objective the promotion of farm woodland improvement.

Forestry students at Purdue University number about 60, and have an active Forestry Club. They exhibited enthusiasm in the work they are undertaking by excellent attendance at the evening forestry meeting.

Students of the Forestry Department at Ames number about 100. They have the advantage of a well developed nursery and a number of forest plantations established during the earlier years on college land. Professor MacDonald has started several experiments in erosion control by planting different species of trees on eroding land.

Auten has been experimenting on photographic processes with a view to developing a technique for photographic soil profiles. It is practically impossible to describe a soil profile so that it may be later identified and distinguished from a similar profile of a related series. Anyone but an expert soils man feels the need for some more exact means of identifying soil types. Pictures in colors would be a very great help.



There are two available methods: Color plates which give a positive in colors suitable only for lantern slides and ordinary prints colored by hand with water or oil colors.

So far the work has been confined to a comparison of Eastman Commercial Panchromatic cut films and Eastman Commercial Portrait films with and without ray filters.

The best results have been obtained with Panchromatic films and a  $K_2$  filter. Better relative color values can generally be secured by the use of a ray filter. The filter cuts out the excess of blue rays and allows the less actinically active rays to record on an equal basis. The filter is especially desirable in photographing yellows and browns so often met in soils.

The water colors are not altogether satisfactory because of the difficulty of getting the exact shade; then, too, water colors being water soluble are rapidly absorbed by the gelatin in the paper and cannot be removed once they sink in. The remedy is to apply the color in very dilute solution; but this carries with it the difficulty of getting the right shade.

A later report will include the results on color plates and the use of oil colors as compared with water colors.

A ray filter was found particularly desirable in photographing crowns of trees against the sky. Detail is practically always lost without a filter because of over exposure to the blue light. With a filter surprising results may be had. The best one for landscape and general forest work is the sky filter. For detail work size  $K_2$  should also be a part of every man's outfit.

#### Oak Yield Study (TS-12)

Height-diameter guide curves have been applied to a large number of the individual plot records and are found to fit satisfactorily when allowance is made for variations in stocking. This latter factor does not materially affect the shape of the curve in the subordinate crown class.

#### Plantation Study (Fp-1)

The work of checking the 400 measurements of black walnut on form 558-a has been continued, but was interrupted by other activities and cooperative work. Errors are found to have crept in despite the diligence and efforts of the field crew to prevent them.

Kellogg has been engaged in making up the annual report for this project. It includes a statement of the work accomplished in 1929, the status of the project to date, and tabulations of the data which have been secured on black walnut and other plantations. The method used to measure standing trees is reviewed to allow others the benefit of this year's experience in this activity.

#### Grazing Project (Pa-1)

Day prepared a bibliography on Grazing in the Farmwoods. He has assembled approximately 50 references on articles which have some scientific merit together with a mass of popular material of little value. An effort was made to check the intensity of grazing as found by the reconnaissance survey in the various physiographic provinces of the region with the amount of stock and pasture land given in the 1925 Census of Agriculture. These figures checked very closely for the highly agricultural districts such as the corn belt, the Blue Grass of Kentucky and the Nashville Basin of Tennessee, but in the poorer agricultural sections there was a wide divergence. This can be, in part at least, explained by the fact that in these sections the farmers turn much of their stock out on wild land or private holdings which are not classed as farms. The check illustrates very forcefully the care which must be taken in analyzing these census figures.

The timber species common to the Oak-Hickory plots have been tentatively grouped into five classes according to the avidity with which they are browsed. Further study of the palatability of the various species is needed before they can be rated on a percentage basis.



Relative Frequency of Browsing of  
Tree Species by Cattle and Horses

Oak-Hickory Type

Central States Region

(Based on the percentage of the reproduction over 6 inches high which had been browsed)

Relished under all conditions	Browsed under light grazing	Browsed under med. grazing	Browsed only under heavy grazing	Rarely browsed even under very heavy grazing
y. poplar	black ash	beech	hawthorne	red gum
white ash	red ash	black gum	post oak	red cedar
sug. maple	river birch	bl. locust	shagbark	ironwood
basswood	box elder	chestnut	hickory	bluebeech
slippery elm	hackberry	bitternut	bl. walnut	pawpaw
mulberry	american	sassafras	Va. pine	persimmon
sycamore	elm	bl. oak	shortleaf	willow oak
sprouts	mockernut	winged elm	pine	pin oak
	hick.(sprts.)	bitternut	bl. cherry	bald cypress
	shagbark	hickory	bl. jack oak	
	hick.sprts.	pignut "	dogwood	
bitternut	hick. sprts.	shellbark "	tupelo gum	
pignut	" "	scarlet oak		
shellbark	" "	sycamore		
chestnut	"	honey locust		
	bl. maple	chestnut oak		
	burr oak sprts.	Ky. coffee tree		
	bl. walnut "			
	red maple			
	white oak			
	red oak			
	southern red oak			

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NORTHEASTERN FOREST EXPERIMENT STATION

Technical bulletin 28 of the New York State College of Forestry, presenting detailed results of Doctor MacAloney's study of the white pine weevil, appeared during the month.

The station has undertaken to revise the census of forest investigations under way in the Northeast, which was compiled in 1924, and Jensen is compiling the material.

Assurance has been given that the Biological Survey will assign a specialist in food habits to the Northeastern station after July 1 to study the relation of birds, mice, moles, and other animals to the white pine weevil. This is part of a renewed attack on the white pine weevil problem planned by the station. Doctor MacAloney is initiating a study of attractants in the hope that successful trapping of the weevil may be developed. He will also undertake a more intensive study of the weevil during the period spent on the ground.

Doctor Metcalf of the Bureau of Plant Industry visited the station during the month. It was decided that Doctor Spaulding, aided by an assistant to be provided by the station, should spend considerable time this season studying the deterioration of birch following logging operations. This problem has already been studied by the station entomologists, who found that the bronze birch borer is probably of secondary importance, and that the action of the shoe-string fungus (*Armillaria* sp.) requires study in this connection, altho indications are that the primary trouble may be found in the inability of the birches to readjust themselves to the change.

Behre and Westveld attended the meeting of the Woodlands Section of the American Paper and Pulp Association in New York February 19. Westveld was on the committee for New England reporting on present and future costs of pulp wood, and took an important part in the discussion by presenting his own figures.

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#### NORTHERN ROCKY MOUNTAIN FOREST EXPERIMENT STATION

Gisborne gave a good share of his attention to drafting the annual investigative report and putting the material of his own studies in order before leaving at the end of the month for his detail to Washington. Weidman finally sent off the manuscript of his yellow pine timber growing and logging practice bulletin to District 6 where it is to be reviewed before submission to Washington. Haig and Averill spent most of their time about equally between the methods-of-cutting and mensuration studies.

One interesting sidelight on the yield situation in the western white pine type is the large amount of understocking due to snow breakage. Compilation of figures on one permanent yield plot in a 55-60-year white pine stand shows that some 6 per cent of the stand by number of trees has been killed during the last five years by snow or snow breakage, and that at the present time about 8 per cent of the live trees are badly bent or have had the tops broken out by snow.

With several other foresters and railway officials, Gisborne made an interesting trip on a Northern Pacific engine over the regular night



freight run from Missoula to Helena to observe the effectiveness of a new type of spark arrester. This device, the invention of Mr. M. F. Brown of the Northern Pacific Railway, dispenses with the screens employed in the ordinary master mechanic's spark arrester and instead employs a device to grind up the cinders so fine that the engine no longer casts fire starting sparks. The device, locally referred to as the "Brown spark arrester," proved very effective, only three sparks being recorded on the entire trip from Missoula to Helena, while on the return trip a similar type engine equipped with the ordinary master mechanic's spark arrester threw great quantities of sparks on both the grade from Helena to the top of the Continental Divide and on the down grade to Missoula. More sparks were thrown on the down grade, a phenomenon not generally known, due to the fact that when the engine is going down hill the fire becomes light as little "green" coal needs to be added and light cinders are readily picked up in the fire box and carried out the stack through the 7x7 mesh screen usually employed. This mesh, with 49 holes to the inch, is the finest that can be used on locomotives and still provide proper steaming qualities.

Thompson reports good progress at the Priest River Branch in the construction of the new fire study instrument shelters. Although February has been relatively warm, with a good percentage of the precipitation in the form of rain, the water system is still frozen and requires considerable attention.

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## PACIFIC NORTHWEST FOREST EXPERIMENT STATION

### General

The annual meeting of the Advisory Council was one of the interesting events of the month. It was held as usual at the University Club in Portland, and twenty were present, of whom fourteen were members of the Council or their substitutes. The work of the Experiment Station, of the Office of Products, and of the Bureau of Entomology Field Station was briefly reviewed and the proposed program for the ensuing year approved. Most of the meeting was devoted to consideration of the scope and plan of work of the Forest Survey project. There was a lively discussion centering around the form in which the material should be released, particularly whether the blocks would be so laid out as to disclose county totals. The Council is very much interested in this project and made many helpful suggestions.

Since Mr. Granger's return the Director has devoted much time to considering the Forest Survey plans with him, particularly personnel. Munger made a two-day trip to Seattle during which he visited a number

of people there with Andrews in connection with the Forest Survey project. He also gave an evening talk on research at the University of Washington Forest Club.

### Natural Reproduction of Douglas Fir

In working up the file records of fifteen groups of semi-permanent reproduction plots scattered over the Douglas fir region, it was surprising to find that 75 per cent of the areas were visited by a second fire since the plots were established on the first burn in 1926. In no instance was the entire area (all plots) reburned, but restocking on that portion of the area which was reburned will be considerably delayed because in all cases the edge of green timber has been cut back rapidly and has now become too distant for adequate re-seeding if a good seed crop did occur.

A summary of seven seed tree survival plots, where approximately two trees per acre were left, shows a variation in survival of 22 to 94 per cent over a period of 2 to 5 years after logging. The areas represented the various sites in the region. The loss was consistently greater on the better sites, with windfall and the slash fire vying for first place among the causes of loss.

### Methods of Cutting Yellow Pine

Kolbe spent the greater part of the month in computing and organizing the Mc plot data for the preparation of progress reports. The 15-year-old Whitman plots which are being analyzed this year show very definitely that we are quite dependent on advance reproduction for natural restocking. The three plots, each 15 acres with a reserve stand of 15 per cent, 25 per cent, and 35 per cent of the original volume, had a total germination during the past fifteen years of 12,276 seedlings per acre. Out of this number, which are mostly yellow pine, only 773 trees or 6 per cent remained alive in the fall of 1929. With results such as these on our Site IV in the Blue Mountains, what may we expect on the poorer sites? It would be interesting to know the results if the slash had been left on the ground instead of piled and burned.

### Mensuration

From several sources, old and new, a collection was made of 767 stem analyses of immature western yellow pine taken in 4 or 5 typical Oregon forests. With these data a cubic-foot volume table was built, thus filling in a need which has long been felt. Next a cubic-foot volume table for mature yellow pine will be made to supplement the regional board foot tables made in 1927 by the Washington Office.



Continued computation of the growth of selectively cut stands of western yellow pine gave the gratifying result that the stand volumes at decade intervals after cutting, starting from varying initial reserves, were susceptible to combination into a yield table by the method of alinement chart modification introduced into Forest Service mensuration by Bruce and Reineke. The basic alinement chart is a very simple one, assuming a constant annual growth for all initial reserves and for all ages after cutting. For Site IV in Oregon, this annual growth was assumed to be 100 board feet a year. The chart of total yield upon this assumption was then modified to show the effect of enlarging reserve and the effect of advancing age upon the total yield. This makes possible estimating the final gross yield with any initial reserve and for any age after cutting up to 60 years in a single simple reading of the chart.

A considerable portion of the computational help was spent in arranging the data obtained from the remeasurement of the permanent sample plots on the Columbia National Forest. Four yield plots of 88-year-old Douglas fir now in their fifteenth year of establishment, three thinning plots of 19-year-old Douglas fir now in their tenth year, a white pine liberation plot in its tenth year, and three newly established plots in sapling Douglas fir had to be analyzed.

### Fire Studies

According to the lookout lightning reports, the annual number of lightning storms has been on the decrease since 1927. In 1927 there were 1,487 reports; in 1928, 813; and in 1929 there were but 517. It only remains for some sun-spot enthusiast to link up this fact with variations in solar activity!

Analyzing the thunderstorm static data was Simson's major activity during the month. According to the lightning reports from the Mt. Hood Forest, the static advices given the central dispatcher on that Forest (both as to intensity and direction) coincided well with thunderstorm behavior. The dispatcher states that the advices were of considerable value in deciding when and where to prepare for lightning fires. There were no lightning storms actually on the Columbia Forest in 1929.

### Forest Survey

Andrews and Matthews visited the headquarters of each of the west side Forests both in Oregon and Washington, the purpose of their visit being to outline to the Supervisors the scope of the Forest Survey project and to try and find out how the prosecution of survey work would fit in with the other duties of the technical men on the Forests assigned to bringing the national forest inventories up to date. They also looked over the work done to date by the men assigned to the Survey

on each Forest. On the Oregon trip they visited a large number of county courthouses and looked over the county cruise records, and called upon the county assessors. They also visited the offices of the State Foresters in both States. They were particularly interested in noting the wide divergence in quality among the various county cruises and also the apparent failure by some assessors to use cruises in assessing timber. On many of the national forests they found that the sources of data were being plotted.

Cowlin, Moravets and Briegleb continued with the collection of data on the O & C lands for the entire state and private ownerships in Northwestern Oregon. Cowlin completed the sawmill map for Oregon. Cowlin and Moravets compared private and county cruise values for 12,000 to 15,000 acres in Washington County. The county cruise showed Douglas fir 10 per cent low and hemlock 50 per cent low as compared to private cruises.

Considerable time was spent on the preparation of detailed administrative working plans. Andrews presented the Survey to the State Board of Forestry at its monthly meeting held in Astoria.

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#### SOUTHERN FOREST EXPERIMENT STATION

##### General

Theo. C. Scheffer, Agent in the Office of Pathology, Bureau of Plant Industry, was assigned to this Station on February 1st. Scheffer received his Master's degree from the University of Washington last June and specialized in Pathology. He will assist Lindgren on the "blue-stain" project.

The Seventh Naval Stores Conference, held February 24-26 at Jacksonville, Fla., was attended by Demmon, Ziegler, and the Starke staff. These men also attended the meeting of the Southeastern Section of the Society of American Foresters, held on February 25th, at which Demmon gave a paper "Relation of Forest Research to Naval Stores Industry."

Demmon spent several days with Mr. Munns and Wyman in Florida looking over areas suitable for a naval stores experiment forest and in going over the work being carried on at Starke. Demmon gave a talk over Station W.W.L. on the work of the Southern Forest Experiment Station.

Mr. A. D. Lindsay, Research Officer of the Australian Commonwealth Bureau, arrived for a five months' visit in the South and will spend most of his time at this Station studying southern pines with a view of



introducing them in Australia. S. P. Nassakin, Forest Service Chemist, Russia, and Alexander V. Vavulin, Forest Service Engineer of Soviet Russia, visited the Station to secure information on our methods of utilization of waste of sawmills.

The Starke branch station was visited during the month by Doctors Knight, Skinner, and Veitch, and Mr. Shingler, all of the Bureau of Chemistry and Soils. Other visitors were Mr. Morrell of the Branch of Public Relations, Mr. Gamble, Editor of the Naval Stores Review, Mr. Council of the Council Tool Company, and Captain Gabriel Andre, special representative of France at the Naval Stores Conference in Jacksonville.

### Naval Stores

Practically all of the field work in preparation for the 1930 chipping season has been completed. The cups and gutters have been raised and the advance streak put on all new faces. The face widths on all trees in the naval stores experiments were marked during this month.

Three half-acre thinning plots were established on the Kingsley experimental area. This experiment is designed to test the practicability of turpentineing to death trees which would ordinarily be taken out in thinning as well as to determine the acceleration in growth due to thinning. The trees to be tapped to death were hung with three-inch to four-inch French faces, no less than two to a tree and as many as four faces on trees above 8 1/2 inches. The gutters were so arranged on the trees that all faces will drain into one cup.

### Management

Chapman and May spent the entire month at Urania. When not working on fire studies, they were occupied in taking the regular five-year measurements on growth plots. Bolts from trees cut in thinning were cut and chipped to the Forest Products Laboratory. A number of plots were established on which methods of cutting will be studied. These plots will also be used in the Forest Products Laboratory Mill Scale Study.

Gemmer has been on detail in the New Orleans Office during February and has been compiling and digesting two years' weather data collected at Camp Pinchot, Florida.

### Protection

Chapman and May spent considerable time during February burning over various fire plots and remarking and remeasuring trees at Urania.

One of the plots measured was the Roberts plot which was established in 1913, and which shows the effect of fire on young longleaf. Data from this plot have been given wide dissemination in the South through colored graphs comparing burned and unburned plots of young longleaf and these measurements will add another chapter to the history of fire in longleaf. Soil samples have been collected before and after burning and will be analyzed for chemical changes by chemists of the Florida Agricultural Experiment Station.

Pessin spent a part of the month working on the progress report of the McNeill grazing project and made a series of pH determinations of the soil samples taken before and after burning at McNeill. No striking contrast was apparent.

### Pathology

At Bogalusa Siggers studied the effect of removal of vegetation from longleaf natural reproduction plots on infection by brown-spot leaf disease. Where vegetation was removed, three plots showed the following per cent of dead leaf tissue:-39.7, 46.9, and 44.0. Where the vegetation was not removed the following per cent of dead leaf tissue resulted:- 28.2, 23.2, and 21.8. This test was run for nine months and shows that vegetation is of value in reducing infection. A solution of casein (1 1/3 oz. in 2 gal.) was tried out as a control for brown-spot, but was found ineffective. Arrangements have been made to raise seedlings of Asiatic chestnut in Louisiana nurseries.

Lindgren and Scheffer ran laboratory tests during the month to determine the corrosive qualities, effect on hands, discoloration, etc., of the chemicals intended for field tests in connection with blue-stain prevention. One small scale mill study was started at Laurel, Miss., in which about 30 chemicals were used. Both pine and sap gum were hand dipped.

### Economics

After completing the report on Appling County, Georgia, early in the month, Ziegler, Bond, and Spillers spent a few days in additional reconnaissance in Alabama and Georgia for a "Roofer" pine study in loblolly and shortleaf pine. Lee County, Alabama, was selected and the remainder of the month was spent in obtaining economic data bearing on the timber situation of this county. It was found that during 1929, 27 portable sawmills cut 31,302,000 board feet of "Roofer" lumber, but that in 1930 there are but 13 mills cutting and the cut will be greatly reduced. The timber is practically all held in small tracts by farmers but has generally been cut over. Fires are not uncommon and prevent stands from becoming properly stocked. Trees are growing rapidly, but due to open character of stands are producing poor quality



material. Much land in this county, due to steep topography and poor soil, is better fitted for timber than agriculture and the timber business is certain to figure as a more important part in the economic development of the county.

### Erosion

During the month Lentz, Sinclair and Meginnis made an extensive survey of Marshall and Lafayette Counties, Mississippi, and found erosion to be quite general with about 8% of each county actively undergoing erosion. A second visit to Linder's pasture after four months lapse of time showed considerable change. Vast quantities of soil had sloughed off and filled up the narrow ravines.

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### SOUTHWESTERN FOREST EXPERIMENT STATION

(January and February)

Compilation of the data on browse range projects has been the major activity the past two months and is now practically complete. Mr. Cooperrider is busily engaged in the preparation of a manuscript covering this work.

The District Investigative Committee meeting was held at Albuquerque during the week of January 6.

According to the published irrigation report for February 28, 9,050 acre feet of water had been impounded behind the new Stewart Mountain Dam recently completed on Salt River. A total of 160,393 acre feet of water is now stored in the four reservoirs on Salt River, having a total capacity of 2,016,000 acre feet. Heavy rains on the watershed are needed to replenish the supply in these storage reservoirs supplying the Salt River Valley.

In the compilation of data on injury to western yellow pine reproduction, some examples of extremely heavy damage by porcupines and timoth were noted. The examples indicate the severity of injury on local areas. They are not representative of average conditions over the experimental areas as a whole.

Timoth occurs generally over the two ranges included in the experimental area. The timoth damage on Plots 110 and 127, the heaviest found, is summarized as follows:

Plot 110, containing 68 specimens of W.Y.P. reproduction.

<u>Degree of damage</u>	<u>Number damaged</u>	<u>Per cent damaged</u>
Light damage	16	23.5
Moderate "	14	20.6
Heavy "	10	14.7
Very heavy "	5	7.3
Extreme "	1	1.5
Total damaged	46	67.6

Plot 127, containing 50 specimens of W.Y.P. reproduction.

<u>Degree of damage</u>	<u>Number damaged</u>	<u>Per cent damaged</u>
Light damage	8	16
Moderate "	12	24
Heavy "	11	22
Very heavy "	11	22
Extreme "	4	8
Total damaged	46	92

The tipmoth injury listed occurs on the current growth of leaders and laterals, retarding height growth and causing small specimens to take on a very bushy form. The damage on Plot 127 corresponds very closely in severity to stock damage on certain plots in areas heavily overgrazed by cattle.

Plot 116 shows an extreme amount of porcupine damage. The injury consists of seedlings cut off and partly or completely girdled a few inches above the ground. The damage on this plot, which contains 186 specimens, is summarized as follows:

<u>Degree of damage</u>	<u>Number damaged</u>	<u>Per cent damaged</u>
Light damage	6	3.5
Moderate "	4	2.2
Heavy "	3	1.6
Extreme "	8	4.3
Killed	69	37.1
Total Killed and damaged	90	48.7

Porcupine damage is locally very destructive to western yellow pine seedlings over the experimental area, and where reproduction is scarce frequently results in gradual elimination. In 1928, blocks containing strychnine, salt and lard were placed in trees in the vicinity of certain plots. In each instance dead porcupines were found in the poisoned areas.

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## BRANCH OF RESEARCH - D-2

### February Activities

Roeser returned from Denver on February 6, remaining several days after the District Investigative meeting to complete the 1929 investigative report and to confer with members of the District office on subjects of administrative, also investigative, nature, the latter primarily in connection with compilation work in the type study. The complete investigative report was received toward the end of the month, and most of the memorandums to the Supervisors were sent out shortly before the first of March. Because of delay in receiving the report, the task of preparing and revising various working plans was postponed until next month.

Board foot volume tables were prepared from available data for the sample management plots for which results have been and are being compiled in the Experiment Station office this winter. These include tables for the Arapaho spruce-fir block, three blocks of Medicine Bow lodgepole, and two of Washakie lodgepole. The inclusion of board foot volume information to make the results of growth studies of greater value to the field men was decided upon after discussing the matter with the Office of Management.

Favorable progress is being made by Leadbeater and Varney in compiling the results of studies on cutting and thinning plots within the District. During the month, such work was completed for sapling and commercial stands of lodgepole on the Washakie, and was well under way for the five plots in the spruce-alpine fir type on the Holy Cross, the oldest of which dates back to 1914.

The task of working over the Fremont hygrometer records, accumulated since 1926 in the local type study and translating these in terms of soil moisture, was pretty well completed by the end of the month, although no summarization of these data was attempted. During 1929 a check with moisture determinations made by actual sampling was conducted and the results of the check will determine the future conduct of this phase of activity in the type and meteorological study.

In connection with meteorological records, the past January saw several established at Fremont which are not likely to be quickly duplicated. The mean minimum temperature for the month was  $2.02^{\circ}$  F. which is  $2.11^{\circ}$  below that of the previous record minimum (February, 1929). The lowest temperature ( $-28.8^{\circ}$  F.) in the 20 year history of the Station was registered, and sub-zero minima prevailed on ten days, also a new record. The average minimum temperature for the second decade was  $-6.13^{\circ}$ , which is  $5.46^{\circ}$  lower than the next lowest figure depicting this condition. The widest daily range yet to be recorded came on January 16 and amounted to  $68.8^{\circ}$  F. This change was registered between 1 and 11 p.m. and  $40.0^{\circ}$

of the drop came within 20 minutes, between 7 and 8 p.m. The wide difference between these extremes becomes more significant when it is realized that this is equivalent to a difference between the freezing point and 100° F., so far as mere figures are concerned.

Soil temperatures at 4' fell to 32° F. on January 24, fully three weeks before the same point was reached during last winter's extremely cold spell. Grave fears were held for the water system, but these were dispelled by the abrupt termination of the cold weather shortly after February 1. In contrast to January with a mean air temperature of 14.94°, making it the coldest month on record at Fremont, February registered a mean temperature of 31.31° F., and was the warmest February which we have ever reported to the Weather Bureau.

The curve of mean air temperatures at Fremont since 1910 (the records for three years are missing) shows two very pronounced peaks in 1910 and 1921, each being followed within two years by a very pronounced low point. Another point of low mean temperature apparently precedes by the same interval each peak of highest mean temperature. To what extent these extremes are related to sun-spot cycles has not been established.

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#### MANUSCRIPTS

##### SOUTHERN

"Some Phases of Forest Management in the Southern Turpentine Region,"  
Paul Rudolf. (For "Gopher Peavey")

##### APPALACHIAN

"Forest Service Sanitation Cuttings - Silvicultural Aspects."  
J. H. Buell. (Address before Appalachian Section, Society  
of American Foresters, February 1930)

##### ALLEGHENY

"The Effect of Cattle Grazing on a Virgin Forest in Western Pennsylvania",  
H. J. Lutz. (For J.A.R.)

##### NORTHEASTERN

"First Progress Report on the Chestnut Replacement Plots, Mt. Toby  
Demonstration Forest", By P. W. Stickel.



PACIFIC NORTHWEST

- "Pacific Coast Pulp Wood Costs." by Isaac and Gibbons (For Woodlands Section of American Paper and Pulp Association.)
- "Firebreaks and Intensive Protection vs. Brushpiling in Pine Regions," T. T. Munger (For Meeting of Western Forestry and Conservation Association at Portland, March 4.)
- "A Method of Constructing Yield Tables for Selectively Cut Stands of Western Yellow Pine." W. H. Meyer (For Journal of Forestry)

IN PRINT

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| Coville, Perkins                    | Improved Forest Tree Seed. Journal of Heredity, October, 1920.  |
| Gast, P. R.<br>and<br>P. W. Stickel | Solar Radiation and Relative Humidity in Relation to Duff Moisture and Forest Fire Hazard. Monthly Weather Review, Nov. 1929. |
| Gast, P. R.                         | A Correlation Between Solar Radiation Intensities and Relative Humidities. Monthly Weather Review, Nov. 1929.                 |
| Munger, T. T.                       | Work Starts on Northwest Forest Resource Survey. West Coast Lumberman, January 1930.  |
| Zon, Raphael                        | Forests and Forestry. Encyclopaedia Britannica. 14th edition. 1929.   |
| Zon, Raphael                        | Erosion in Wisconsin - in New Science for an Old Art - Wisconsin Agricultural Experiment Station Bulletin 410, pp. 1-6.       |

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## FOREST PRODUCTS - District One

### Logging-Milling Studies

A check made in this office based on data obtained in the tree-to-mill-green-chain studies in western yellow pine show that the value of the products in the log or tree must be figures on a piece tally by width and thickness under each grade in order to give a true comparison of the effect of size on value.

In the earlier mill scale studies the contents of each individual log were tallied by grade only. The width, thickness and length of each piece was not recorded or if recorded was not segregated under the grade of summaries. In the 1925 mill scale studies in this District the footage of each piece was tallied under selected width classes under each grade. These width classes were selected to show the effect of width on price. The select grades for instance had two width segregations, i.e., 4 to 8 inches wide (narrow stock), and 10 inches and wider (wide stock). There were no segregations under the shop grades as this stock is sold in random widths. The thickness and length of each piece was not recorded. It was the opinion at the time of the studies that it was impracticable to attempt to record the length, width and thickness and grade of each piece cut from the log. In the mill scale part of the tree-to-mill-green-chain studies of 1928, it was found that the length, width, thickness, and grade of each piece could be recorded accurately by an alert tallyman and good grader.

The table which follows compares the value of the products cut from western yellow pine trees of different diameters with prices figured on (a) a piece tally by grades only and (b) a piece tally by width and thickness under each grade.

:Value per M ft. Lbr. Tally: Differences

Tree D.B.H. : Green Chain Basis : (b) as base

Inches	:	(a)	:	(b)	:	+	:	-
12		\$28.89		\$27.01		\$1.88		
13		25.30		24.65		.65		
14		27.92		26.37		1.55		
15		26.33		25.36		.97		
16		26.04		24.82		1.22		
17		26.84		25.63		1.21		
18		27.63		26.42		1.21		
19		27.92		27.47		.45		
20		29.66		29.34		.32		
21		30.30		30.13		.17		
22		29.34		29.88		.54		
23		30.01		31.23		.22		
24		31.11		32.09		.98		



		: Value per M ft. Lbr. Tally	:	Differences
Tree D. B. H.	:	Green Chain Basis	:	(b) as base
Inches		(a)	:	(b)
			:	+
			:	-
25	\$31.47	\$34.01		2.54
26	30.41	32.12		1.71
27	28.23	30.03		1.80
28	32.93	36.37		3.44
29	24.55	25.64		1.09
30	28.67	29.88		1.21
31	30.88	33.37		2.49
32	29.89	32.55		2.66
33	32.71	37.64		4.93
34	30.06	32.19		2.13
35	30.37	32.46		2.09
36	31.85	35.29		3.44
38	33.72	37.07		3.35

Based on W.P.M.A. prices for 1928

Values based on grade segregations alone give too high a figure for the products of the small logs and trees and too low a value for the large ones. It is obvious that wider boards in all the grades can be cut from large logs than from the very small ones. With a price spread for example of \$4 per M (W.P.M.A. - 1928 Ponderosa Pine) between 4-inch and 13-inch & wider D select it is evident that values based on a grade segregation alone do not give large logs the credit they deserve. Thicker boards in certain grades can also be cut from the larger logs. The price spread for thickness is nearly as great as that for width. The same length of board can be cut from a small log as from a large one and though there is a spread in price for length it has to date been disregarded.

#### Stub-Treating Costs Bozeman-Flathead Telephone Line

A progress report from the Gallatin Forest shows the following costs for lodgepole pine stubs treated with Anaconda Wood Preservative (granulated treater dust) as compared with a creosote-petroleum treatment using 40% creosote and 60% gas oil.

	Cost of Delivered Stub	Cost of Preservative Delivered	Cost of Treating	Total
Creosote-gas oil	22¢	38.4¢	62.5¢	\$1.229
Treater dust	22¢	38.9¢	10 ¢	.709

The stubs treated were 8 feet long with 7 inch minimum top diameter. Cutting and peeling of 900 stubs was done at a contract price of 22 cents each. These stubs were seasoned for 7 to 8 months before treatment.

In the creosote-petroleum treatment the stubs were heated for 7 hours after the mixture had reached 180° F. and then allowed to cool over night in the tank. This resulted in an average penetration of 1.21 inches and an average absorption of approximately 1.5 gallons per stub.

In treating with Anaconda Wood Preservative six pounds of the granulated treater dust per stub was used. One pound was placed in the bottom of the hole, spread out to the size of the stub which was placed directly upon it. The hole was partly filled to a point half way between the bottom and 10 inches below the ground line. A space was then made about an inch wide and 4 inches deep, around the stub with a wedge-shaped stick, and two pounds of the preservative put in this space, collar-wise, around the stub. Dirt was carefully placed on top and carefully tamped to avoid disturbing the treater dust. The hole was then filled within about 10 inches of the top and the operation repeated, using 3 pounds of the treater dust for the third application or upper collar. One man was assigned to all the treater dust applications to secure uniform results.

It is expected that a very good check on the relative value of the creosote petroleum mixture as compared with the granulated treater dust will be obtained from this installation. Test strips have been designated where the open-tank treated and arsenic treated stubs will be alternated in the line. About 40% of the stubs were installed in the fall of 1929 and setting will be completed during the present year.

#### Progress of Idaho-Montana Lumber and Timber Products Canvass

Mailing of all first requests was completed in this District during the second week of February. Address lists for Montana and North Idaho at the beginning of this canvass included 628 names and there are 175 concerns in South Idaho from which reports will be obtained by D-4. Fifty returns were received from the District Forester at Ogden on February 17. About 36% of the returns have been received for North Idaho and 40% for Montana.

The operators are making a very good response to the first call but owing to the longer and more comprehensive schedule being used this year the reports received require considerably more editing and follow-up than has been necessary in previous biennial censuses. At least 20% of the reports on the large Form 311 W. S. require letters requesting additional information or explanation.



### Breakage in Felling Study

Field work and office compilation have been completed for the yellow pine type. The analysis and presentation in the form of a trade journal article will be made before May 1.

Approximately 70 man days have been contributed this winter by the Blackfeet, St. Joe and Clearwater Forests on the white pine and larch-Douglas fir type. Scaler Standiford of the St. Joe Forest followed sawyers when the thermometer stood at 30 degrees below zero in order to secure information on overmature white pine stands.

### Fire Depreciation Study

The office compilation for this project is complete and the data will be analyzed and presented to the industry in the next issue of The Timberman. Fire depreciation value losses will be shown by one-inch log size classes for fire-killed logs salvaged and sawed up one and two years after the burn. Eight-inch fire-killed Idaho white pine logs salvaged and cut up two years after the burn show a loss in lumber selling value of \$2.15 per M lumber tally; the 14-inch logs a loss in value of \$4.53 per M, and the 22-inch logs a loss of \$8.38 per M. The loss in value of fire-killed Idaho white pine logs salvaged and sawed up one year after the burn is almost negligible when compared to the above losses.

### Woods Studies

Mr. Anderson has started the preliminary office work necessary for a log bucking for grade study in yellow pine. Part of the time of one temporary computing clerk is being spent on a compilation of the yield of lumber by grade, length and width from yellow pine butt logs. Particular attention is being given to a comparison of the lumber yield from fire scarred butts versus sound butts. One objective of this study is a determination of the actual damage of recurring fires to yellow pine trees of merchantable size.

### Lumber Prices and Movement

Av. Mill-Run Prices	Annual,	1st.Q.	2nd Q.	3rd Q.	4th Q.
	1928	1929	1929	1929	1929
Idaho White Pine	\$31.09	\$32.13	\$35.22	\$34.88	\$35.66
Western Yellow Pine	24.51	26.18	26.61	26.51	25.27
Larch-Fir	18.55	20.81	20.85	20.68	19.08
White Fir	18.26	20.53	22.18	20.41	20.10
Spruce	23.20	22.66	25.92	24.91	24.10

<u>Shipments &amp; Cut</u>	<u>January, 1929</u>	<u>January, 1930</u>
Shipments	127,626	105,395
Cut	105,215	185,806

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### FOREST PRODUCTS - District Six

#### Branch of Research

Felling and Bucking Study in the Douglas Fir Region:- Mr. Spelman completed his report "Notes on Log Scaling and Grading in the Douglas Fir Region" (80 pages). The report is largely the result of the past season's work. Aside from matter essential to the carrying on of the felling and bucking study, the report contains incidental information which will be of interest to those engaged in national forest timber sale administration. The purpose of the report is not to discuss log scaling and grading in all its phases. Neither the information assembled, nor the special purpose it is to serve, warranted such treatment.

Work so far done on the felling and bucking study brings out the fact that only about 10 per cent of the larger operators in the Douglas fir region pay fallers and buckers on a daily wage basis, which is almost a complete change in conditions of 15 years ago. At that time, fallers and buckers were paid by the day, whereas today most of them are paid on a contract basis, or at a unit price per thousand feet log scale for sawlogs produced.

The contract method of payment, popularly spoken of as "bushel work", has come into use as a means of securing greater output per man per day. Men apparently work harder under this method of payment and earn more money in a day than under a daily wage basis. Fallers and buckers, in camps paying day wages, usually earn from \$4.50 to \$6.00 per day whereas in camps that use the contract system, they usually earn \$7.00 to \$9.00 a day.

For the most part "bushel work" seems to attract the more experienced and skilled workmen due to the better wages that may be earned and for this reason generally better work is done at contract camps than at camps paying day wages. However, the tendency for increased output under the contract system often results in a sacrifice of care and judgment, with consequent greater breakage and other woods losses.

Some unsatisfactory features of the contract system which some operators are recognizing and are attempting to overcome include:



(a) Not enough premium is paid for high-class work and conversely not enough penalty results for excessive breakage or poor work. Some operators attempt to remedy this by paying fallers only for the log scale to the first break in a tree.

(b) There is too much variation in the compensation received for trees of different sizes with respect to labor performed. Bull buckers and superintendents can not confidently adjust the contract price per thousand for timber of different sizes on the basis of labor time required to do the work. It is interesting to note in this connection that the Long-Bell Lumber Company is studying and experimenting with modifications of the contract system. They have in mind either developing a sliding scale for timber of different sizes on the basis of time studies or using a combination day wage and bonus system.

Kiln-Drying Short Course:- During the second week of February a short course in kiln-drying for small sawmill operators was held at the School of Forestry, Corvallis, Oregon. Nine operators were in attendance throughout the course. The regular faculty was augmented by the services of Mr. A. C. Knauss, Kiln operator of the Oregon-American Lumber Company. A number of others delivered talks on various phases of lumber drying. In this latter connection Mr. Johnson of our Products office gave a talk to the short-course men and senior forestry students on the air-seasoning of Douglas fir common.

Although the outside attendance at the course was not large, a great deal of interest was shown throughout. While designed primarily for small sawmill operators, many of the larger operators would find it well worth their while to take advantage of this course which the School is planning to give each year.

Utilization of Bigleaf Maple:- Johnson's report "Utilization of Bigleaf Maple of the Pacific Northwest" was completed during the month. Copies were submitted to the Laboratory, the Washington office, the Experiment Station, and the Office of Forest Management for a critical review. We hope that the report can be published as a Department bulletin.

General Survey of Sawmill Waste in the Douglas Fir Region:- Mr. Hodgson spent the entire month of February in preparing for and in supervising the field work of a crew of eleven men which was used in conducting a study of sawmill waste at four representative hemlock sawmills in the Grays Harbor and Puget Sound districts of Washington. Messrs. Johnson and Spelman also devoted the bulk of the month to this study. The study was cooperative in nature since the personnel of the crew was contributed by the Offices of Forest Products and Forest Management in the District Office, the Mt. Baker National Forest, and the West Coast Lumbermen's Association. The owners of sawmills studied not only cooperated in the work by permitting the study to be conducted

in their plants but also contributed considerable labor and went to more or less expense in making it possible to secure accurate data.

The plan provided for a scale of the logs, log measurements from which the cubic contents of the logs and bark may be computed, an accurate piece tally (width, thickness, and length) of the lumber, a piece tally (length, width and thickness) of the different classes of waste (slabs, edgings, trimmings, etc.) after they had passed through the slasher, and in one case sawdust measurements behind the different saws.

With the information collected, it will be possible to secure a comparison between the log scale, by runs of logs, and the actual amount of lumber produced from them, as well as the percentage of the log lost as waste in the various steps of manufacturing rough sawed lumber.

The present utilization of the so-called sawmill waste was also studied and from the data collected it will be possible to state what part of it is being used and in what form.

The study, it is believed, will also provide some valuable information regarding conversion factors, such as, for example, the amount of pulp chips which may be recovered under commercial practice from waste wood resulting from the manufacture of hemlock logs, of known volume, into lumber.

Pulp and Paper:- At the request of the Woodland Section, American Pulp and Paper Association, a hurry-up report on "Pacific Coast Pulpwood Costs" was prepared by Gibbons and L. A. Isaac of the Experiment Station in accordance with an outline furnished by them.

Of the factors affecting pulpwood costs in the Pacific Northwest, wood waste, so-called, is increasing in importance. There are, in fact, great possibilities in the integration of the lumber and paper industries in the Pacific Coast region, which would make entirely feasible large use of both logging and sawmill waste for pulp.

Logging operations in the Douglas fir region of Oregon and Washington annually produce at least 750,000 cords of small and low-grade Douglas fir, western hemlock, spruce and fir logs, which are difficult to dispose of profitably and which doubtless could be used more advantageously for pulp than lumber. It would be possible to obtain from the areas logged annually an additional 750,000 cords by taking out material but little smaller or but little more defective than that which is now logged for lumber. It is therefore possible to obtain about 1,500,000 cords of pulpwood annually from operations designed primarily for lumber, without taking into account the possibility of utilizing an additional 4,500,000 cords of material left annually in woods in the form of small or broken timber.



The utilization of lumber and box mill waste for paper pulp in the Douglas fir region is well past the experimental stage. A negligible amount of slabs and other mill waste has been used for years by the paper industry of the region, but it is only in the last three or four years that such waste has been used in large volume for pulp. Now practically all the pulp mills use sawmill waste. It is estimated that the pulp mills of Washington now use annually for pulp sawmill waste equivalent to about 650,000 units<sup>1</sup> of pulp chips.

Ordinarily the waste is converted into pulp chips at the sawmills, with the necessary equipment installed and operated by the pulp manufacturers themselves. Almost without exception new pulp plants have been located with regard to supplies of sawmill waste.

One illustration will serve to indicate the trend toward tying together of the lumber and pulp-manufacturing industries. A Douglas fir and a western hemlock mill, each under separate ownership and management and each producing about 275 thousand board feet of lumber per 8-hour shift, stand side by side on tidewater near an electric power plant jointly owned by the two lumbering companies. Very near the hemlock sawmill, but representing an entirely separate unit so far as ownership and management are concerned, is a 150-ton sulphite pulp mill of substantial construction and modern design. Mill waste from the sawmills, principally the Douglas fir mill, in hogged form, serves as fuel for the power plant, with the latter supplying not only the light and power requirements of the sawmills and pulp mill but also a large part of the light for general use in the county. A very large proportion of the hemlock mill waste is converted into pulp chips at the sawmill, with the chips conveyed to the pulp mill at a minimum of cost and trouble; only the rotten material goes to the burner. Hemlock mill waste, formerly utilized for lath, is also converted into pulp chips.

#### 1929 Census of Lumber, Lath, Shingles, Logs, Cooperage and Veneer:-

As reported in the January report, the office mailed out a total of 2750 first requests. This number included approximately 1424 "new" companies or companies from whom no previous report had ever been received. It is to be expected that the bulk of these so-called new companies will prove to be non-existent, or in some business other than producing one of the above-named articles. However, returns already received suggest that a number of active mills will be picked up in this manner, giving warrant to the canvass of such an apparently large number of questionable companies.

During the month of February approximately 996 replies of one kind or another were received, many of which do not represent complete returns, making a certain amount of correspondence with individual companies necessary. It will be noted that about 36 per cent of the companies have replied to date.

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<sup>1</sup>A cubic measure, consisting of 200 cubic feet, used for sawdust, hogged fuel and pulp chips. A cord yields somewhat more than a unit of chips.

Publications:- The fifth part of "The Effect of Tree Sizes on Western Yellow Pine Lumber Values and Production Costs" by Gibbons, Johnson and Spelman appeared in the February issue of The Timberman.

The January issues of Pacific Pulp and Paper Industry and the West Coast Lumberman presented an article by Hodgson entitled, "Unutilized Trees Left After Logging in the Douglas Fir Region."

Early in February Hodgson delivered a talk before the Linnton Community Club on the subject "Logging Waste in the Douglas Fir Region". Extracts of his talk were printed in the local newspapers.

Reference has been made to the lecture on air-seasoning by Johnson delivered at Oregon State College.

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## FOREST TAXATION INQUIRY

A field study of forest taxation was begun in North Carolina. Wager, who has direct charge of this study, reported on February 3 in order to orient himself with respect to the entire program of the Inquiry and to confer in regard to various North Carolina plans. It was agreed that there would be rather intensive studies in three selected counties, one representing the Tidewater, one the Piedmont, and one the Mountain region, and that assessment ratio studies would be attempted in this connection.

Wager and Hall visited Washington consulting Marsh with reference to the selection of counties and other matters pertaining to the proposed activities in North Carolina. Wager proceeded to that state and has continued the development of plans on the ground together with other preliminary work.

Murphy spent the last part of the month at the New Haven office superintending the completion of a set of tables which embodies the statistical results of the New Hampshire study.

Fairchild and Herbert have given attention to putting into final form a progress report dealing with forest tax laws which have been passed since the date covered by the last progress report on this subject. Herbert has also made considerable progress in working up his Michigan projects.

Fairchild represented the Inquiry at the Virginia Commercial Forestry Conference at Richmond on February 12, giving an address entitled "Some Fundamentals of the Forest Taxation Problem." A great deal of interest was manifested in the subject of taxation at the Conference.

Conferences were held at the New Haven office with H. B. Shepard and C. M. Granger in regard to certain phases of their respective fields. There was also a conference with State Forester P. H. Merrill of Vermont in regard to a proposed study of forest taxation in that state.

In the latter part of the month R. E. Marsh from the Washington office spent several days at New Haven in getting in touch with the latest developments in the work of the Inquiry and in discussing plans for the annual Program Conference and other matters.

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## RANGE RESEARCH

### WASHINGTON

#### Our Range Livestock Prices at Bottom

The monthly letter to animal husbandmen of Armour's Livestock Bureau for February, 1930, discusses the crisis in wool. It brings out that today the price situation in wool is the most serious it has been since the war. A 65 per cent drop in wool prices has taken place since November 1924, and during the past year a drop of 30 per cent has brought prices to a bottom level. These prices are about the same as those prevailing in 1913 disregarding the tariff. The difficulties in the wool situation are not based entirely on production. The woolen industry was overdeveloped during the war and a surplus plant capacity simulating price competition in order to keep machinery going had not been closed until recently. Not only is wool seriously depressed but the position of lamb feeders is especially unfortunate. Prices are low and the overproduction can only be taken care of by the most careful avoidance of market gluts through orderly marketing. The number of sheep and lambs have been increasing yearly until in 1930 numbers in the United States reached almost 49,000,000. Considerable reduction in values of range sheep have already occurred but there is serious question as to whether these values have yet reached bottom. The woolen industry feels that wool prices have become so low that they will become stabilized or may even have a rising tendency.

The beef cattle situation is not good. Feeders are having to sell the fattened stock at several dollars a hundred weight under what they paid. This is bound to have a reflection on range livestock values although values of cattle on the range apparently have not felt the effect of the general depression as greatly as sheep. Numbers of cattle have decreased in recent years, following a contrary trend to that of sheep.

The situation will bear the closest watching and emphasizes the importance of the development and application of the best range management principles possible.

#### Prospective Range Plants from Northern Africa

Prof. E. T. Bioletti of the University of California has left for northern Africa under the auspices of the Office of Foreign Plant Introduction of the Department. He aims particularly to look for table grapes and apricots. Upon the suggestion of Mr. K. A. Everson, in charge of the Office of Foreign Plant Introduction, Chapline and Dayton had a conference with Prof. Bioletti with a view to discussing with him the need for looking for plants which may be suitable for



reseeding our drier western ranges. The parts of Morocco and Algeria where Prof. Bioletti is going are rather typical of the Southwest and parts of California. It is hoped that he may find some suitable plants particularly on the plains, and in the foothills of the Atlas Mountains, which will be of aid in improving range forage and in erosion control.

#### McGinnies' "The Quadrat" Issued

Prof. McGinnies' article "The Quadrat" was issued in the January 1930 issue of the Journal of Forestry. This brief article outlines the main quadrat features which McGinnies followed in his Montana range investigations. One copy of the reprint is being sent to each Research unit and a small supply will be held for any additional requests.

#### FORAGE INVESTIGATIONS

A considerable part of the month was devoted to the Junior Range Examiner examination and organization matters.

#### General Browse Bulletin

Dayton went over with Hunn and Mrs. Timmons the changes made in the latest editorial revision of the manuscript, and it has been made ready for final copy before going over to the Department.

At Dr. Coville's request Dayton prepared and sent to him a list of the English plant names used in the general browse bulletin.

#### Flora of Arizona

Prof. Hitchcock, who has recently returned to work after a serious operation has now gone over 87 Arizona or near-Arizona Forest Service grass specimens, as a result of Dayton's memorandum of April 22, 1929, reviewing Dr. Hitchcock's Poaceae chapter of Tidestrom & Thornber's Flora of Arizona. While many of these 87 specimens have had their names changed on check-identification, as anticipated, yet a substantial number of additions to the flora of Arizona have been made.

#### Plant Identification

300 plants, representing 13 collections, were submitted to the Bureau of Plant Industry for identification in February. Considerable time was spent on check - identification of old specimens. One hundred and one plants were mounted.

## GREAT BASIN EXPERIMENT STATION

### General

Associate Range Examiner E. W. Nelson completed the revision of his manuscript "Management of Black Grama in Relation to Climate and Grazing" during the month, and resubmitted it to the editorial mill.

Associate Range Examiner F. G. Renner revised and brought up to date his bibliography on range management subjects and submitted it to the Washington office for review and publication.

Senior Silviculturist L. F. Watts left on February 18 for an assignment of two months to assist in the Office of Experiment Stations in Washington.

### Water Users' Conferences

Director Forsling attended the first National Water Users' Conference sponsored by the American Farm Bureau Foundation, at Reno, Nevada, on February 26, 27, and 28. He gave a paper on the "Relationship of forest and range lands to erosion control as affecting the water user", accompanied by some lantern slides showing various kinds and degrees of erosion and silting of reservoirs.

The meeting was attended by representatives of the 11 western states except Montana, Washington and Arizona; by representatives of the Extension Service, U. S. Reclamation Service, U. S. Bureau of Public Roads, and Districts 2 and 4 and the Great Basin Experiment Station of the Forest Service. Other papers at the meeting dealt with the financing and refinancing of irrigation projects, land settlement policies, underground water development, economic studies on irrigation projects, the need of further experimental work on problems of irrigation farming, and water users and national legislation. There was a keen interest in all of the papers and the lively discussion which followed each. Resolutions were adopted urging federal financing and/or refinancing of irrigation projects, leveeing, drainage, district bonds and other indebtedness; making available at an early date, the results of economic research work in connection with irrigation districts; that ownership and control of power developed in connection with irrigation projects be retained for the benefit of the district or community and for agriculture; that underground water be put under the same control and administration as the surface water of the states and that surveys be undertaken in the near future for the purpose of designating the specific localities of needed livestock watering places on the public domain; a nation-wide policy be adopted in the handling of the public domain that will protect against erosion and conserve the watersheds of the irrigation farmers of the West; that a study be made of the amount and rate of silting of irrigation streams and reservoirs; the fulfillment of the authorizations of the McSweeney-McNary research act as



related to watershed lands, and recommending sufficient appropriation for the study of causes of erosion and methods of preventing erosion and conserving the water supply on watershed lands.

Forsling presented some information on silting in the various reservoirs as follows:

Arrowrock Reservoir in Idaho, completed in 1915, contained between 7000 and 8000 acre-feet of sediment in 1928. This is a reduction in storage capacity of approximately 3% and in terms of dam construction is equivalent to a loss of \$100,000: the Roosevelt Reservoir in Arizona, completed in 1911, contained 101,000 acre-feet of silt or 6% of the total storage capacity by 1925; this amounts to a loss of \$239,000 as a pro rata share of the construction costs. The Elephant Butte reservoir in New Mexico, completed in 1916, contained 231,735 acre-feet of silt or 8.8% of the original capacity by 1925. The pro rata construction cost of the total storage lost to 1925 was about \$400,000. The Zuni Reservoir, on the Zuni Indian reservation in northern New Mexico, completed in 1907 with a capacity of 15,100 acre-feet and costing \$98,000 was over 70% filled with silt after 22 years as the result of overgrazing on the watershed. The Lake McMillan Reservoir on the Pecos River in New Mexico, constructed in 1894, and which had a capacity of 45,000 acre-feet, contained 44,900 acre-feet of silt in 1925. Silting in this reservoir has been slower in recent years on account of the growth of a shrub on the delta on the upper end of the reservoir which is intercepting the silt and prevented its being carried into the reservoir. The best available information indicates that 137,000 acre-feet of silt is the normal quantity annually transported through the lower end of the Grand Canyon of the Colorado River. At this rate 1-1/3 million acre-feet of the capacity would be lost every 10-year period in a reservoir constructed on this stream.

Forsling attended the annual meeting of the water users on the Boise project at Boise, Idaho, on March 3, where he discussed the Boise River watershed problem. He pointed out the apparent reduction in streamflow, the earlier run-off in recent years and the erosion situation. It was indicated that climate has been one of the major factors influencing streamflow in recent years, although it appears that some other factors apparently are at work which are causing more sudden run-off in the spring.

Governor Baldrige of Idaho also addressed the Boise River water users, his subject being "Twenty-five years' observations on the Boise River." He pointed out that a number of factors were apparently responsible for the acute water situation on this stream. Among other things he stated that the growing of crops that required more water than those formerly grown should be taken into consideration, but since such crops are required to make irrigation farming profitable, greater efforts are needed to conserve the available water supply. He pointed out also the importance of utilizing the timber and forage crops on

watershed lands and that there should be no unnecessary waste of these resources. On the other hand, he stated that they should not be utilized in a manner to endanger the water supply, and emphasized that much study and thought was necessary to adequately work out this problem to the best interests of all concerned.

### Spring-Fall Range Study

Craddock's analysis of the data obtained during the last seven years in spring-fall range study at the U. S. Sheep Experiment Station is bringing out a great many interesting points. The results which have been obtained in paddocks 1 and 2, for example, forcefully bring out the effect that systems of grazing may have on the carrying capacity and plant cover on the range. These paddocks are each 80 acres in area and were practically alike when the systems of grazing were first applied in 1923. Since that time No. 1 has been grazed in the fall only of each year. Number 2 has been grazed from the time growth starts in the spring, usually the latter part of April, until near the end of the main growing season about the middle of June, and then again late in the fall. According to the records of the actual number of sheep-days feed obtained from each paddock, No. 2 produced 89% as much forage in 1924, as did paddock 1. After 6 years of such grazing, paddock 2 in 1929, produced only 31% as many sheep-days feed as did No. 1, or in other words, there has been a loss of 65% in grazing capacity of paddock 2 as compared to paddock 1. Paddock 1 has improved slightly but not as much as might have been expected on account of the frequent dry years which have intervened.

The relationship of these two paddocks is further shown by range survey and major plot data obtained from each. The range survey values indicate that in 1924 paddock 2 was 96% as good as No. 1. In 1928, the range survey data showed that No. 2 was only 38% as good as No. 1. The major plot values show that No. 2 was 90% as good as No. 1 in 1924, and only 31% as good in 1929. A sample plot transect of 20 stations in each paddock further substantiated the relationship in 1929. This comparison showed that No. 2 was only 31% as good as No. 1. These results show excellent correlation of actual carrying capacity, range survey data, major plots and sample plot transects.

### Artificial Reseeding Tests

Extensive artificial reseeding tests were started, chiefly in the spring range type, during the 1929 field season. A large part of this work is in connection with testing varieties of sweet clover in cooperation with the Bureau of Plant Industry. This Bureau provided an allotment of \$2000 for the project including the construction of three rabbit-proof enclosures from 10 to 42 acres in area, in which the cooperative tests are being carried out. Plantings, involving several



methods of treatment were made in June and October on fenced areas as well as on grazed ranges. The following table gives the species and varieties being tried in all of the tests, the source of seed, and the number of plantation and nursery trials started with each.

Species	Source of Seed	No. tests		
		Plantation	Nursery	Total
<u>Tame Species</u>				
<u>Grasses</u>				
Bromus sp.	Lawrence, Kansas	10	0	10
" inermis	Oak Zone - Manti N. F.	0	1	1
Poa bulbosa	Medford, Ore.	0	2	2
" canadensis	Oak Zone - Manti, N. F.	0	1	1
	(Dickinson, N. D.			
	(Creston, Mont.			
Agropyron cristatum	(Bur. Plant Industry	19	4	23
	(Oak Zone - Manti N. F.			
Festuca rubra	Minneapolis, Minn.	2	0	2
Dactylis glomerata	G.B.E.S. Nursery	0	1	1
Phleum pratense	" " " " "	0	1	1
<u>Others</u>				
Alsike clover	Minneapolis, Minn.	0	1	1
White Clover	Ogden, Utah	0	1	1
	(Salt Lake City, Utah			
White sweet clovers	(Bur. Plant Industry	27	7	34
	(Salt Lake City, Utah			
Yellow sweet clover	(Sioux City, Iowa	17	3	20
	(Bur. Plant Industry			
Total Tests of Tame Species		75	22	97
<u>Native Species</u>				
<u>Grasses</u>				
Agropyron caninum	Cache N. F.	0	2	2
" sp.	Tahoe N. F.	0	1	1
" spicatum	Oak Zone - Manti N. F.	0	1	1
" tenerum	" " " " "	0	2	2
" violaceum	Ephraim Canyon - Manti N.F.	2	2	4
Bromus carinatus	Stanislaus N. F.	0	1	1
" marginatus	(G.B.E.S. - Manti N. F.	0	1	1
	(Oak Zone - " " "	0	1	1
" polyanthus	(G.B.E.S. Nursery	12	1	13
	(Oak Zone - Manti N. F.	0	1	1
" porteri	Black Hills N. F.	0	1	1
" pumpellianus	Leadville N. F.	0	1	1
" sp.	Tahoe N. F.	0	4	4
" subvelutinus	Oak Zone - Manti N. F.	0	2	2
Danthonia sp.	Pikes Peak N. F.	0	2	2
Elymus sp.	Tahoe N. F.	0	4	4
Festuca thurberi	San Juan N. F.	0	2	2
Muhlenbergia gracilis	" " " "	0	3	3
Poa pratensis	Oak Zone - Manti N. F.	0	2	2
" sp.	Tahoe N. F.	0	1	1
Total Tests of Native Species		14	35	49

A total of 146 plantation and nursery sowings were made involving the use of 18 native grasses; 8 tame grasses, the yellow and white sweet clovers and the alsike and white clovers. Eighty-nine of the plantation tests are on plots varying in size from .12 acres to 4.5 acres. Seven of these tests, of which two are with the white sweet clovers, are on grazed areas. In five trials, the seed was sown broadcast and then trampled by sheep. In the pasture tests, 60 of the sowings were made on land prepared by plowing furrows about three feet apart paralleling the contour of the land, and then the seed was covered with a brush harrow. Six plots received no treatment of the soil and the remaining ten were trampled by sheep after the seed was sown.

Extensive sowings of the sweet clovers were made in the three fenced pastures in order to test out several strains, seed of which was furnished by the Bureau of Plant Industry. From these sowings it may be possible to determine which strain of sweet clover may be more suited to our climatic and soil conditions in the oak zone.

Late fall examinations of the June sowings showed some rather interesting results considering the lateness of sowing. The best stands of seedlings occurred where the seed was sown in the plowed furrows and then covered with a brush harrow. Even though the common brome from Kansas had the best stand of seedlings, yet the crested wheatgrass seedlings had made a more vigorous height growth and root development. The yellow sweet clover areas showed a better stand of seedlings than the white sweet clover areas and had made slightly better height growth.

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#### SANTA RITA RANGE RESERVE

#### Precipitation Records (Cont'd from November)

Another phase of the rainfall study deals with the variation in amount of precipitation between stations that are comparatively short distances apart. The data for this was secured by placing rain gages at various points over the reserve (five in each of the mesa and semi-desert type and six in the foothill type). The records start with the summer of 1922 and show rainfall by months up to the present time. The summer precipitation (July to Sept., incl.) in the foothill type is given in the following table together with the elevation of each station and a table of airline distances between stations:



Station		White House	Forest	Florida Station	Parker	Proctor	Ruelas
Elevation		3900'	4200'	4300'	4700'	4200'	4500'
Air	White H.	0	2.1	2.2	4.1	5.1	6.6
Line	Forest	2.1	0	.6	2.0	3.4	5.1
Distances	Florida	2.2	.6	0	2.0	3.6	5.6
in Miles	Parker	4.1	2.0	2.0	0	2.3	4.3
Between	Proctor	5.1	3.4	3.6	2.3	0	2.1
Stations	Ruelas	6.6	5.1	5.6	4.3	2.1	0
Amount	1922	8.04	8.66	8.04	9.08	9.44	*
of	1923	14.34	15.11	14.53	13.26	10.92	*
Precipi-	1924	3.64	4.10	5.13	7.03	6.37	5.75
tation	1925	5.12	4.19	6.59	8.11	9.63	9.52
	1926	8.60	10.71	12.08	8.46	7.90	8.16
in	1927	11.28	8.65	9.25	8.33	8.57	12.50
	1928	8.23	5.53	7.26	8.26	8.59	5.66
inches	1929	11.52	13.13	17.31	15.95	11.63	9.18
Average		8.85	8.76	10.02	9.85	9.13	8.89

\*Record starts in 1924.

The range in elevation is from 3900 to 4700 feet while the greatest distance between stations is 6.6 miles. Generally speaking elevation appears to play the most important role in determining the amount of rainfall recorded. However, there are many instances where it has very evidently not been the prime factor. Location of the stations with respect to the highest part of the Santa Rita Mountains undoubtedly has an influence though observations have indicated that it is very erratic. Explanation of the variations would require records covering a much longer period of time and the most important feature at the present time is that we realize the possible extent of rainfall variation in connection with our range improvement and range maintenance studies. Years of plentiful rainfall may minimize the significance of these variations somewhat, but in average or below-average years there is every indication that they are a most important factor in the interpretation of results obtained in our studies of the vegetation. The variation of over four inches between Forest and Florida Stations in 1929 was perhaps relatively insignificant but the variation of almost two and a half inches in 1925 (with total rainfall roughly a third of that which occurred in 1929) unquestionably exerted a profound influence upon both density and height growth of vegetation. The total amount of rainfall for any given season is only a small part of the story since its distribution throughout the period is equally as important and can only be determined by actual measurements. During the period that this study has been made many careful ocular estimates of extent and amount of rains have been attempted with the result that when checked by actual measurements they were worse than useless.

The indications so far are that our rainfall records should be kept on a weekly basis at the very outside and preferably on a daily basis at certain stations, and that such records are essential to the proper analysis of results in range studies work.

#### Miscellaneous

During the month Ruelas disposed of all his surplus calves, yearlings, two-year-old steers and cows at \$40.00, \$50.00, \$60.00 and \$56.50, respectively.

Ruelas recently secured a well driller and has started a well at Helvetia. When that is completed he plans to move the outfit to his home ranch and put down a well in hope of securing sufficient water to enable him to pipe it into the south part of pasture No. 6. He has already purchased sufficient pipe for this purpose as well as to complete his lines into pastures 5 and 15.

Good general rains occurred over the entire reserve during the last week in February and green growth is starting everywhere. With just another rain or so we should have an excellent spring season as cattle are in good to excellent shape all over the reserve.

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#### JORNADA RANGE RESERVE

##### Rainfall Deficient

Two light rains during the month amounted to only 0.07 inch precipitation. In spite of this the weeds seem to be making a good start at growth and some of the grasses are greening up. Low wind movement has helped conserve what moisture is in the ground and warm days are bringing new growth fast.

##### Maintenance

While compilation of field data is going on continually, the chief effort this month has been to paint the outside of the government houses before the sand storms commence in earnest. In spite of considering weather conditions before painting, several small storms caught the paint while fresh and the result looks like a smooth stucco.



### Cooperator Sells Old Stock

The cooperator has been busy this month improving the Jornada herd by selling the old cows. A carload of weak and old cows was sold to the El Paso stock yards and 450 head of old cows went to the alfalfa fields in California. The latter averaged \$52.50 a head. He intends to buy younger, more vigorous cows in the spring if conditions are good.

### Aldous Returns

S. E. Aldous of the Biological Survey returned to the Jornada on February 21 to continue his study of rabbit-control methods. He is going to establish some feeding experiments on jack rabbits and also try to determine how much importance the coyotes are playing in the rodent situation.

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